IN THE CLAIMS

What is claimed is:

1. A multiplexing system, comprising:
at least two light sources suitable for providing respective input light beams each having respective light wavelengths; and
a multi-dimensional grating suitable for receiving said input light beams and diffracting at least one said light wavelength to form a single output light beam, thereby multiplexing said light wavelengths such that they are present in said output light beam.

2. The multiplexing system of claim 1, wherein:
said light wavelength from one said light source is a principal wavelength;
said light wavelength from the other said light source is a diffractable wavelength; and
said multi-dimensional grating is arranged such that said input light beam having said principal wavelength is received and passed therethrough and said input light beam having said diffractable wavelength is received and said diffractable wavelength is combined with said principal wavelength.

3. The multiplexing system of claim 2, wherein said principal wavelength is a plurality or range of wavelengths, thereby producing said output light beam with an addition of said diffractable wavelength into said plurality or range of wavelengths.

4. The multiplexing system of claim 1, wherein:
at least one said light source provides its respective said light wavelength including a plurality of wavelengths; and
said multi-dimensional grating has characteristics suitable for diffracting said plurality of wavelengths concurrently.

5. The multiplexing system of claim 1, wherein:
at least one said light source provides its respective said light wavelength including a range of wavelengths; and

said multi-dimensional grating has characteristics suitable for diffracting said range of wavelengths.

6. The multiplexing system of claim 1, wherein said multi-dimensional grating is a planar grating.

7. The multiplexing system of claim 6, wherein:

said planar grating is optically two-dimensionally asymmetrical; and

said light wavelengths are each respectively diffracted by said planar grating with respect to one asymmetric dimension, thereby permitting said planar grating to multiplex both of said diffractable wavelengths into said output light beam.

8. The multiplexing system of claim 1, wherein said multi-dimensional grating is a cubical grating.

9. The multiplexing system of claim 8, wherein:

said cubical grating is optically two-dimensionally asymmetrical; and

said light wavelengths are each respectively diffracted by said cubical grating with respect to one asymmetric dimension, thereby permitting said cubical grating to multiplex both of said diffractable wavelengths into said output light beam.

10. The multiplexing system of claim 8, further comprising:

a third said light source also suitable for providing a said input light beam having a said light wavelength;

and wherein:

said cubical grating is optically three-dimensionally asymmetrical; and

said light wavelengths are each respectively diffracted by said cubical grating with respect to one asymmetric dimension, thereby permitting said cubical grating to multiplex all three of said diffractable wavelengths into said output light beam.

11. The multiplexing system of claim 1, wherein the multiplexing system includes a plurality of said multi-dimensional gratings and a plurality of said light sources such in number that each said multi-dimensional grating has at least one said light source providing its respective said light wavelength to that said multi-dimensional grating.

12. The multiplexing system of claim 11, wherein said plurality of said multi-dimensional gratings are physically discrete.

13. The multiplexing system of claim 11, wherein said plurality of said multi-dimensional gratings are integrated into one contiguous physical unit.

14. The multiplexing system of claim 1, wherein:

the multiplexing system includes at least two said light sources which provide respective said input light beams having respective wavelength sets comprising pluralities of wavelengths of light;

the multiplexing system includes a plurality of said multi-dimensional gratings suitably arranged to form at least one and as many as three input grating blocks;

the multiplexing system includes a plurality of said multi-dimensional gratings suitably arranged to form an output grating block;

said input grating blocks are each suitably arranged to receive one said input light beam and to diffractably provide its said wavelength set to said output grating block; and

said output grating block is suitably arranged to receive said wavelength sets from said input grating blocks and to diffractably combine said wavelength sets such that they are present in said output light beam, thereby interleaving all said wavelengths of light.

15. The multiplexing system of claim 14, wherein:

said multi-dimensional gratings in said output grating block are planar gratings; and

two said input grating blocks provide said wavelength sets to said output grating block.

16. The multiplexing system of claim 14, wherein:

said multi-dimensional gratings in said output grating block are cubical gratings; and

two said input grating blocks provide said wavelength sets to said output grating block.

17. The multiplexing system of claim 14, wherein:

said multi-dimensional gratings in said output grating block are cubical gratings; and

three said input grating blocks provide said wavelength sets to said output grating block.

18. A de-multiplexing system, comprising:

a light source suitable for providing an input light beam having at least two light wavelengths; and

a multi-dimensional grating suitable for receiving said input light beam and diffracting at least one said light wavelength to form two output light beams, thereby de-multiplexing said light wavelengths into respective said output light beams.

19. The de-multiplexing system of claim 18, wherein:

one said light wavelength is a principal wavelength;

the other said light wavelength is a diffractable wavelength; and

said multi-dimensional grating is arranged such that said light beam is received and said principal wavelength is passed therethrough and said diffractable wavelength is separated from said principal wavelength.

20. The de-multiplexing system of claim 19, wherein said principal wavelength is a plurality or range of wavelengths, thereby producing one said output light beam having said diffractable wavelength and the other said output light beam having said plurality or range of wavelengths.

21. The de-multiplexing system of claim 18, wherein:

at least one said light wavelength includes a plurality of wavelengths; and

said multi-dimensional grating has characteristics suitable for diffracting said plurality of wavelengths concurrently.

22. The de-multiplexing system of claim 18, wherein:

at least one said light wavelength includes a range of wavelengths; and

said multi-dimensional grating has characteristics suitable for diffracting said range of wavelengths.

23. The de-multiplexing system of claim 18, wherein said multi-dimensional grating is a planar grating.

24. The de-multiplexing system of claim 23, wherein:

said planar grating is optically two-dimensionally asymmetrical; and

said light wavelengths are each respectively diffracted by said planar grating with respect to one asymmetric dimension, thereby permitting said planar grating to de-multiplex said diffractable wavelengths into respective said output light beams.

25. The de-multiplexing system of claim 18, wherein said multi-dimensional grating is a cubical grating.

26. The de-multiplexing system of claim 25, wherein:

said cubical grating is optically two-dimensionally asymmetrical; and

said light wavelengths are each respectively diffracted by said cubical grating with respect to one asymmetric dimension, thereby permitting said cubical grating to de-multiplex said diffractable wavelengths into respective said output light beams.

27. The de-multiplexing system of claim 25, wherein:

said light source further provides said light beam having a third said light wavelength;

said cubical grating is optically three-dimensionally asymmetrical; and

said light wavelengths are each respectively diffracted by said cubical grating with respect to one asymmetric dimension, thereby permitting said cubical grating to de-multiplex said diffractable wavelengths into respective said output light beams.

28. The de-multiplexing system of claim 18, wherein the de-multiplexing system includes a

plurality of said multi-dimensional gratings and said light source provides said light beam with a plurality of said light wavelengths such in number that each said multi-dimensional grating separates at least one said light wavelength.

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29. The de-multiplexing system of claim 28, wherein said plurality of said multi-dimensional gratings are physically discrete.

30. The de-multiplexing system of claim 28, wherein said plurality of said multi-dimensional gratings are integrated into one contiguous physical unit.

31. The de-multiplexing system of claim 18, wherein:

said light wavelengths are wavelength sets comprising pluralities of wavelengths of light;

the de-multiplexing system includes a plurality of said multi-dimensional gratings suitably arranged to form an input grating block;

the de-multiplexing system includes a plurality of said multi-dimensional gratings suitably arranged to form at least one and as many as three output grating blocks;

said input grating block is suitably arranged to receive said input light beam and to diffractably provide each said wavelength set to a respective said output grating block; and

said output grating blocks are suitably arranged to each receive one said wavelength set from said input grating block and to diffractably provide its said wavelength set as a different said output light beam, thereby de-interleaving all said wavelengths of light.

32. The de-multiplexing system of claim 32, wherein:

said multi-dimensional gratings in said input grating block are planar gratings; and

two said output grating blocks receive said wavelength sets from said input grating block.

33. The de-multiplexing system of claim 32, wherein:

said multi-dimensional gratings in said input grating block are cubical gratings; and

two said output grating blocks receive said wavelength sets from said input grating block.

34. The de-multiplexing system of claim 32, wherein:
said multi-dimensional gratings in said input grating block are cubical gratings; and
three said output grating blocks receive said wavelength sets from said input grating block.

35. A method for multiplexing, comprising the steps of:
(a) providing at least two input light beams each having respective light wavelengths; and
(b) diffracting at least one said light wavelength in a multi-dimensional grating to combinably form a single output light beam.

36. The method of claim 35, wherein:
said light wavelength from one said light source is defined to be a principal wavelength and said light wavelengths from other said light sources are defined to be a diffractable wavelength; and
said step (b) includes arranging said multi-dimensional grating such that said input light beam having said principal wavelength is received and passed therethrough and said light beam having said diffractable wavelength is received and said diffractable wavelength is combined with said principal wavelength.

37. The method of claim 36, wherein said principal wavelength is a plurality or range of wavelengths, thereby producing said output light beam with an addition of said diffractable wavelength into said plurality or range of wavelengths.

38. The method of claim 35, wherein:
at least one said light wavelength includes a plurality of wavelengths; and
said step (b) includes diffracting said plurality of wavelengths concurrently in said multi-dimensional grating.

39. The method of claim 35, wherein:

at least one said light wavelength includes a range of wavelengths; and

said step (b) includes diffracting said range of wavelengths in said multi-dimensional grating.

40. The method of claim 35, wherein said step (b) includes concurrently diffracting two said light wavelengths respectively with optical two-dimensional asymmetry in said multi-dimensional grating.

41. The method of claim 35, wherein said step (b) includes concurrently diffracting three said light wavelengths respectively with optical three-dimensional asymmetry in said multi-dimensional grating.

42. The method of claim 35, wherein:

said step (a) includes providing a plurality of said input light beams each having respective light wavelengths; and

said step (b) includes diffracting at least one said light wavelength in each of a plurality of said multi-dimensional gratings.

43. The method of claim 42, wherein said plurality of said multi-dimensional gratings are physically discrete.

44. The method of claim 42, wherein said plurality of said multi-dimensional gratings are integrated into one contiguous physical unit.

45. The method of claim 35, wherein:

said step (a) includes providing said input light beams having respective wavelength sets comprising pluralities of wavelengths of light; and

said step (b) includes:

receiving each said input light beam in an input grating block formed of said multi-dimensional gratings;

diffractably providing said wavelength sets to an output grating block formed of

said multi-dimensional gratings; and

diffractably combining said wavelength sets to form said output light beam, thereby interleaving all said wavelengths of light.

46. The method of claim 45, wherein:

said multi-dimensional gratings in said output grating block are planar gratings; and

said step (b) includes providing two said input grating blocks.

47. The method of claim 45, wherein:

said multi-dimensional gratings in said output grating block are cubical gratings; and

said step (b) includes providing two said input grating blocks.

48. The method of claim 45, wherein:

said multi-dimensional gratings in said output grating block are cubical gratings; and

said step (b) includes providing three said input grating blocks.

49. A method for de-multiplexing, comprising the steps of:

(a) providing an input light beam each having at least two light wavelengths; and

(b) diffracting at least one said light wavelength in a multi-dimensional grating to seperably form at least two output light beams.

50. The method of claim 49, wherein:

one said light wavelength is defined to be a principal wavelength and other said light wavelengths are defined to be diffractable wavelengths; and

said step (b) includes receiving and passing said principal wavelength through said multi-dimensional grating and receiving and diffractably combining said diffractable wavelength with said principal wavelength.

51. The method of claim 50, wherein said principal wavelength is a plurality or range of wavelengths, thereby producing one said output light beam having said plurality or range of wavelengths and other said output light beams having said diffractable wavelengths.

52. The method of claim 49, wherein:
at least one said light wavelength includes a plurality of wavelengths; and
said step (b) includes diffracting said plurality of wavelengths concurrently in said multi-dimensional grating.

53. The method of claim 49, wherein:
at least one said light wavelength includes a range of wavelengths; and
said step (b) includes diffracting said range of wavelengths in said multi-dimensional grating.

54. The method of claim 49, wherein said step (b) includes concurrently diffracting two said light wavelengths respectively with optical two-dimensional asymmetry in said multi-dimensional grating.

55. The method of claim 49, wherein said step (b) includes concurrently diffracting three said light wavelengths respectively with optical three-dimensional asymmetry in said multi-dimensional grating.

56. The method of claim 49, wherein:
said step (a) includes providing said input light beam having a plurality of respective said light wavelengths; and
said step (b) includes diffracting at least one said light wavelength in each of a plurality of said multi-dimensional gratings.

57. The method of claim 49, wherein:
said step (a) includes providing said input light beam having multiple wavelength sets comprising pluralities of wavelengths of light; and
said step (b) includes:
receiving said input light beam in an input grating block of said multi-dimensional gratings;

diffractably separating said wavelength sets in said input grating block and providing each said wavelength set to a respective output grating block of said multi-dimensional gratings; and

diffractably forming each said wavelength set into one said output light beam in a respective said output grating block, thereby de-interleaving all said wavelengths of light.

58. The method of claim 57, wherein:
said multi-dimensional gratings in said input grating block are planar gratings; and
said step (b) includes providing two said output grating blocks.

59. The method of claim 57, wherein:
said multi-dimensional gratings in said input grating block are cubical gratings; and
said step (b) includes providing two said output grating blocks.

60. The method of claim 57, wherein:
said multi-dimensional gratings in said input grating block are cubical gratings; and
said step (b) includes providing three said output grating blocks.